

WHAT IS CLAIMED IS:

- 1 1. A network device comprising:
2 a duplicate packet map (DPM).
- 1 2. The network device of claim 1, wherein said DPM comprises:
2 a plurality of DPM fields.
- 1 3. The network device of claim 2, wherein
2 said DPM is configured to receive a packet summary value (PSV).
- 1 4. The network device of claim 3, wherein said DPM is implemented as a
2 Bloom filter.
- 1 5. The network device of claim 3, wherein
2 a one of said DPM fields corresponds to said PSV.
- 1 6. The network device of claim 3, wherein
2 each of said DPM fields corresponds to a bit in said PSV.
- 1 7. The network device of claim 3, wherein
2 each of said DPM fields is configured to compare a value of a corresponding
3 bit of said PSV with a value stored in said each of said DPM fields to
4 generate an output, and
5 a value of each of said outputs indicates whether said value of said
6 corresponding bit of said PSV matches said value stored in said each of
7 said DPM fields.
- 1 8. The network device of claim 3, wherein
2 each of said DPM fields is configured to be addressed using said PSV, and
3 a value stored in a one of said DPM fields corresponding to a value of said
4 PSV indicates whether said packet is said duplicate packet.
- 1 9. The network device of claim 1, further comprising:
2 a packet summary value (PSV) generator, wherein

3 said duplicate packet map (DPM) is coupled to said PSV generator.

1 10. The network device of claim 9, wherein
2 said PSV generator is configured to generate a PSV based on a packet
3 received by said PSV generator, and
4 said DPM is configured to receive said PSV.

1 11. The network device of claim 9, wherein said DPM comprises:
2 a plurality of DPM fields.

1 12. The network device of claim 11, wherein
2 a one of said DPM fields corresponds to said PSV.

1 13. The network device of claim 11, wherein
2 each of said DPM fields corresponds to a bit in said PSV.

1 14. The network device of claim 12, wherein said DPM is implemented as
2 a Bloom filter.

1 15. The network device of claim 1, further comprising:
2 a DPM bank, wherein
3 said DPM bank comprises said DPM.

1 16. The network device of claim 15, wherein said DPM bank further
2 comprises:
3 a plurality of DPMs, wherein said DPMs comprise said DPM.

1 17. The network device of claim 16, wherein
2 each of said DPMs is implemented as a Bloom filter.

1 18. The network device of claim 16, wherein
2 a first one of said DPMs is designated as a current DPM, and
3 a second one of said DPMs is designated as a previous DPM.

1 19. The network device of claim 16, wherein said DPM bank further
2 comprises:
3 a DPM addressing unit coupled to said DPMs;
4 a selection unit coupled to said DPMs; and
5 a DPM control unit, coupled to control said DPM addressing unit, said DPMs
6 and said selection unit.

1 20. The network device of claim 19, wherein
2 said DPM control unit is configured to select a first one of said DPMs as a
3 current DPM and a second one of said DPMs as a previous DPM.

1 21. The network device of claim 20, wherein
2 said DPM control unit is configured to cause said DPM addressing unit to
3 provide said PSV to said current DPM and said previous DPM; and
4 said DPM control unit is configured to cause said selection unit to select said
5 current DPM and said previous DPM.

1 22. The network device of claim 20, wherein
2 said DPM control unit is configured to select said previous DPM as an
3 inactive DPM and to clear said inactive DPM.

1 23. The network device of claim 15, further comprising:
2 a packet summary value (PSV) generator, wherein
3 said duplicate packet map (DPM) is coupled to said PSV generator.

1 24. The network device of claim 23, wherein said DPM bank further
2 comprises:
3 a DPM addressing unit coupled between said PSV generator and said DPMs;
4 and
5 a selection unit coupled to said DPMs.

- 1 25. The network device of claim 24, wherein said DPM bank further
2 comprises:
3 a DPM control unit, coupled to control said DPM addressing unit, said DPMs
4 and said selection unit.
- 1 26. The network device of claim 25, wherein
2 said selection unit is configured to generate a hit signal, and
3 said hit signal indicates that bit values of said PSV match bit values stored in
4 corresponding locations in a one of said DPMs.
- 1 27. The network device of claim 9, wherein
2 said PSV generator is configured to generate a PSV based on a packet
3 received by said PSV generator, and
4 said DPM is configured to receive said PSV.
- 1 28. The network device of claim 27, wherein
2 said DPM is further configured to indicate that said PSV matches a PSV
3 stored in said DPM.
- 1 29. The network device of claim 28, wherein said PSV generator is
2 configured to generate said PSV using a cyclic redundancy check computation.
- 1 30. The network device of claim 9, further comprising:
2 a packet processing unit, said packet processing unit comprising said PSV
3 generator.
- 1 31. The network device of claim 30, further comprising:
2 a DPM bank, wherein
3 said DPM bank comprises said DPM,
4 said DPM bank is configured to generate a hit signal, and
5 said DPM bank is coupled to receive said PSV from said PSV
6 generator and to provide said hit signal to said packet
7 processing unit.

1 32. The network device of claim 31, wherein
2 said hit signal indicates that a value of said PSV matches a value stored in a
3 one of said DPMs.

1 33. The network device of claim 31, wherein
2 said hit signal indicates that bit values of said PSV match bit values stored in
3 corresponding locations in a one of said DPMs.

1 34. The network device of claim 31, wherein
2 said packet processing unit is configured to process said packet using said hit
3 signal.

1 35. The network device of claim 31, wherein
2 said processing includes causing said packet processing unit to drop said
3 packet based on said hit signal.

1 36. A method for determining if a packet is a duplicate packet, comprising:
2 determining if a field of a duplicate packet map (DPM) indicates said packet is
3 said duplicate packet, wherein
4 said determination is made using a packet summary value (PSV)
5 corresponding to said packet.

1 37. The method of claim 36, further comprising:
2 indicating said packet is said duplicate packet, if said determination
3 determines said packet is said duplicate packet.

1 38. The method of claim 37, further comprising:
2 dropping said packet, if said packet is said duplicate packet.

1 39. The method of claim 37, wherein said determining comprises:
2 39 said PSV to said DPM.

1 40. The method of claim 39, wherein
2 said determination is made by comparing a bit of said PSV with a bit stored in
3 said field of said DPM, and
4 said indicating is performed if said bit of said PSV matches said bit stored in
5 said field of said DPM.

1 41. The method of claim 40, further comprising:
2 setting said bit stored in said field of said DPM to a value of said bit of said
3 PSV.

1 42. The method of claim 37, wherein said determining comprises:
2 selecting said field of said DPM based on said PSV.

1 43. The method of claim 42, wherein
2 said determination is made by selecting said field of said DPM based on a
3 value of said PSV, and
4 said indicating is performed if a value stored in said field of said DPM
5 indicates that said packet is said duplicate packet.

1 44. The method of claim 43, further comprising:
2 setting said value stored in said field of said DPM, if said packet is not said
3 duplicate packet.

1 45. The method of claim 44, further comprising:
2 generating said PSV by generating a cyclic redundancy check value based on
3 information in said packet.

1 46. The method of claim 37, wherein
2 said DPM is a one of a plurality of DPMs.

1 47. The method of claim 46, further comprising:
2 selecting a first DPM of said DPMs as a previous DPM; and
3 selecting a second DPM of said DPMs as a current DPM.

1 48. The method of claim 47, further comprising:
 2 determining if a field of said previous DPM indicates said packet is said
 3 duplicate packet, using said PSV; and
 4 determining if a field of said current DPM indicates said packet is said
 5 duplicate packet, using said PSV.

1 49. The method of claim 48, further comprising:
 2 indicating said packet is not said duplicate packet, if said field of said previous
 3 DPM indicates said packet is not said duplicate packet and said field of
 4 said current DPM indicates said packet is not said duplicate packet,
 5 and
 6 indicating said packet is said duplicate packet, otherwise.

1 50. The method of claim 47, further comprising:
 2 selecting said previous DPM as an inactive DPM;
 3 selecting said current DPM as said previous DPM; and
 4 selecting another DPM of said DPMs as said current DPM.

1 51. The method of claim 50, further comprising:
 2 clearing said inactive DPM prior to said inactive DPM being selected as said
 3 current DPM.

1 52. The method of claim 50, wherein
 2 said selecting said previous DPM as said inactive DPM, said selecting said
 3 current DPM as said previous DPM, and said selecting said another
 4 DPM of said DPMs as said current DPM are performed periodically.

1 53. The method of claim 52, wherein
 2 a period of said performing periodically is such that said period is greater than
 3 an expected differential between duplicate packet arrivals and said
 4 period is less than a time between packet retransmissions.

1 54. The method of claim 52, wherein
 2 a period of said performing periodically is configured to allow said inactive
 3 DPM to be cleared prior to said inactive DPM being selected as said
 4 current DPM.

1 55. A network device comprising:
 2 a processor;
 3 computer readable medium coupled to said processor; and
 4 computer code, encoded in said computer readable medium, for determining if
 5 a packet is a duplicate packet and configured to cause said processor
 6 to:
 7 determine if a field of a duplicate packet map (DPM) indicates said
 8 packet is said duplicate packet, wherein
 9 said computer code configured to cause said processor to
 10 determine uses a packet summary value (PSV)
 11 corresponding to said packet.

1 56. The network device of claim 55, wherein said computer code is further
 2 configured to cause said processor to:
 3 indicate said packet is said duplicate packet, if said computer code configured
 4 to cause said processor to determine determines said packet is said
 5 duplicate packet.

1 57. The network device of claim 56, wherein said computer code is further
 2 configured to cause said processor to:
 3 compare said PSV to said DPM.

1 58. The network device of claim 56, wherein said computer code is further
 2 configured to cause said processor to:
 3 select said field of said DPM based on said PSV.

1 59. The network device of claim 58, wherein said computer code is further
2 configured to cause said processor to:
3 generate said PSV by virtue of being configured to generate a cyclic
4 redundancy check value based on information in said packet.

1 60. The network device of claim 55, wherein
2 said DPM is a one of a plurality of DPMs.

1 61. The network device of claim 60, wherein said computer code is further
2 configured to cause said processor to:
3 select a first DPM of said DPMs as a previous DPM; and
4 select a second DPM of said DPMs as a current DPM.

1 62. The network device of claim 61, wherein said computer code is further
2 configured to cause said processor to:
3 determine if a field of said previous DPM indicates said packet is said
4 duplicate packet, using said PSV; and
5 determine if a field of said current DPM indicates said packet is said duplicate
6 packet, using said PSV.

1 63. The network device of claim 62, wherein said computer code is further
2 configured to cause said processor to:
3 indicate said packet is not said duplicate packet, if said field of said previous
4 DPM indicates said packet is not said duplicate packet and said field of
5 said current DPM indicates said packet is not said duplicate packet,
6 and
7 indicate said packet is said duplicate packet, otherwise.

1 64. The network device of claim 61, wherein said computer code is further
2 configured to cause said processor to:
3 select said previous DPM as an inactive DPM;
4 select said current DPM as said previous DPM; and
5 select another DPM of said DPMs as said current DPM.

1 65. The network device of claim 64, wherein
 2 said computer code further configured to cause said processor to select said
 3 previous DPM as said inactive DPM, said computer code further
 4 configured to cause said processor to select said current DPM as said
 5 previous DPM, and said computer code further configured to cause
 6 said processor to select said another DPM of said DPMs as said current
 7 DPM are further configured to be performed periodically.

1 66. The network device of claim 65, wherein
 2 a period of said performing periodically is such that said period is greater than
 3 an expected differential between duplicate packet arrivals and said
 4 period is less than a time between packet retransmissions.

1 67. The network device of claim 65, wherein
 2 a period of said performing periodically is configured to allow said inactive
 3 DPM to be cleared prior to said inactive DPM being selected as said
 4 current DPM.

1 68. A computer program product for determining if a packet is a duplicate
 2 packet, comprising:
 3 a first set of instructions, executable on a computer system, configured to
 4 determine if a field of a duplicate packet map (DPM) indicates said
 5 packet is said duplicate packet, wherein
 6 said first set of instructions makes said determination using a packet
 7 summary value (PSV) corresponding to said packet; and
 8 computer readable media, wherein said computer program product is encoded
 9 in said computer readable media.

1 69. The computer program product of claim 68, further comprising:
 2 a second set of instructions, executable on said computer system, configured
 3 to indicate said packet is said duplicate packet, if said computer code
 4 configured to cause said processor to determine determines said packet
 5 is said duplicate packet.

1 70. The computer program product of claim 69, further comprising:
2 a third set of instructions, executable on said computer system, configured to
3 compare said PSV to said DPM.

1 71. The computer program product of claim 69, further comprising:
2 a third set of instructions, executable on said computer system, configured to
3 select said field of said DPM based on said PSV.

1 72. The computer program product of claim 71, further comprising:
2 a fourth set of instructions, executable on said computer system, configured to
3 generate said PSV by virtue of being configured to generate a cyclic
4 redundancy check value based on information in said packet.

1 73. The computer program product of claim 68, wherein
2 said DPM is a one of a plurality of DPMs.

1 74. The computer program product of claim 73, further comprising:
2 a second set of instructions, executable on said computer system, configured
3 to select a first DPM of said DPMs as a previous DPM; and
4 a third set of instructions, executable on said computer system, configured to
5 select a second DPM of said DPMs as a current DPM.

1 75. The computer program product of claim 74, further comprising:
2 a fourth set of instructions, executable on said computer system, configured to
3 determine if a field of said previous DPM indicates said packet is said
4 duplicate packet, using said PSV; and
5 a fifth set of instructions, executable on said computer system, configured to
6 determine if a field of said current DPM indicates said packet is said
7 duplicate packet, using said PSV.

1 76. The computer program product of claim 75, further comprising:
2 a sixth set of instructions, executable on said computer system, configured to
3 indicate said packet is not said duplicate packet, if said field of said

4 previous DPM indicates said packet is not said duplicate packet and
 5 said field of said current DPM indicates said packet is not said
 6 duplicate packet, and
 7 a seventh set of instructions, executable on said computer system, configured
 8 to indicate said packet is said duplicate packet, otherwise.

1 77. The computer program product of claim 74, further comprising:
 2 a fourth set of instructions, executable on said computer system, configured to
 3 select said previous DPM as an inactive DPM;
 4 a fifth set of instructions, executable on said computer system, configured to
 5 select said current DPM as said previous DPM; and
 6 a sixth set of instructions, executable on said computer system, configured to
 7 select another DPM of said DPMs as said current DPM.

1 78. The computer program product of claim 77, wherein
 2 said fourth, said fifth, and said sixth set of instructions are performed
 3 periodically.

1 79. The computer program product of claim 68, wherein
 2 a period of said performing periodically is such that said period is greater than
 3 an expected differential between duplicate packet arrivals and said
 4 period is less than a time between packet retransmissions.

1 80. The computer program product of claim 68, wherein
 2 a period of said performing periodically is configured to allow said inactive
 3 DPM to be cleared prior to said inactive DPM being selected as said
 4 current DPM.

1 81. An apparatus method for determining if a packet is a duplicate packet,
 2 comprising:
 3 means for determining if a field of a duplicate packet map (DPM) indicates
 4 said packet is said duplicate packet, wherein
 5 said means for determining uses a packet summary value (PSV)
 6 corresponding to said packet.

1 82. The apparatus of claim 81, further comprising:
 2 means for indicating said packet is said duplicate packet, said means for
 3 indicating configured to indicate said packet is said duplicate packet if
 4 said means for determining determines said packet is said duplicate
 5 packet.

1 83. The apparatus of claim 82, wherein said determining comprises:
 2 means for comparing said PSV to said DPM.

1 84. The apparatus of claim 82, wherein said determining comprises:
 2 means for selecting said field of said DPM based on said PSV.

1 85. The apparatus of claim 84, further comprising:
 2 means for generating said PSV comprising a means for generating a cyclic
 3 redundancy check value based on information in said packet.

1 86. The apparatus of claim 82, wherein
 2 said DPM is a one of a plurality of DPMs.

1 87. The apparatus of claim 86, further comprising:
 2 means for selecting a first DPM of said DPMs as a previous DPM; and
 3 means for selecting a second DPM of said DPMs as a current DPM.

1 88. The apparatus of claim 87, further comprising:
 2 means for determining if a field of said previous DPM indicates said packet is
 3 said duplicate packet, using said PSV; and
 4 means for determining if a field of said current DPM indicates said packet is
 5 said duplicate packet, using said PSV.

1 89. The apparatus of claim 88, further comprising:
 2 means for indicating said packet is not said duplicate packet, if said field of
 3 said previous DPM indicates said packet is not said duplicate packet

4 and said field of said current DPM indicates said packet is not said
5 duplicate packet, and
6 means for indicating said packet is said duplicate packet, otherwise.

1 90. The apparatus of claim 87, further comprising:
2 means for selecting said previous DPM as an inactive DPM;
3 means for selecting said current DPM as said previous DPM; and
4 means for selecting another DPM of said DPMs as said current DPM.

1 91. The apparatus of claim 90, further comprising:
2 means for clearing said inactive DPM prior to said inactive DPM being
3 selected as said current DPM.

1 92. The apparatus of claim 90, wherein
2 said means for selecting said previous DPM as said inactive DPM, said means
3 for selecting said current DPM as said previous DPM, and said means
4 for selecting said another DPM of said DPMs as said current DPM
5 perform their respective selections periodically.